



EPA Response to DTSC Comments on Draft Omega OU2 FS

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Cc: Lynda Deschambault, Stephen Berninger, Tom.Perina

04/20/2010 12:59 PM

Hi Juli and Lori -

Attached you will find a table that provides EPA's responses to the comments DTSC provided in February on the January 2010 Draft Feasibility Study for OU2. This is in follow-up to our earlier discussion (which focused primarily on plume characteristics and groundwater modeling) with DTSC staff about the agency's comments. We hope this additional information will facilitate your review of the draft Proposed Plan.

Please let me know if you have any questions regarding the attached. Thanks.



EPA response to DTSC comments on Draft FS for Omega OU2.doc

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EPA Response to DTSC Comments (dated 2/26/2010) on the January 2010 Draft Omega OU2 FS

General Comments

| | DTSC Comment | EPA Response |
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| 1 | <p>The overall plume velocity used in the text is questionable, because it includes parts of the plume that reasonably could have come from downgradient sources. The calculation apparently assumes that the entire extent of the PCE plume beyond Angeles/McKesson is Omega's, not Angeles/McKesson's.</p> <p>This assumption is questionable, because there are other PCE sources downgradient of Omega.</p> <p>DTSC suggests 1,4-dioxane is a better tracer to use because it is not subject to degradation or retardation, and represents true groundwater velocity.</p> <p>Based on 1,4-dioxane concentrations, it is not clear that the main Omega plume extends beyond Angeles/McKesson, and recalculation gives a velocity of 200'/yr and results in less than half the quoted velocity.</p> | <p>The RI/FS estimation of the apparent plume expansion rates are an empirical calculation (length/time) using the length of plume (from the source of contamination) and an estimation of the first release date (both Omega and AMK begin in 1976 so 30 years). There are only two substantial source areas along the main contaminant transport pathway - Omega and AMK – and the PCE plume beyond AMK is a result of releases at both source areas. Other sources are relatively small and/or not along the pathway. The discussion is included in Section 6 of the RI. The rate calculations are summarized in Table 6-2 of the RI.</p> <p>DTSC stated in the Angeles RI (DTSC, 2007 Section 1.3.4), that contamination from the Omega facility has been interpreted to extend past Angeles Chemical. It appears that DTSC at that time accepted this interpretation. The second off-property investigation report for McKesson (Geosyntec, 2007) cites the DTSC (2007) RI for Angeles as a source of information for the extent of contamination from the Omega facility past McKesson.</p> <p>The plume expansion rates were evaluated for several compounds including 1,4-dioxane in the RI. Table 6-2 of the RI lists all of these plume migration rates.</p> <p>Per table 6-2, 1,4-dioxane migration rates are 770 ft/yr assuming Omega is the source, or 530 ft/yr if you assume 1,4-dioxane came from AMK. Please also note that the "plume migration rates" estimated in the RI are not velocities but <u>apparent</u>, long term average rates of increase in the plume length, or rates of plume expansion along the main</p> |

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| | | <p>contaminant transport pathway. The rates were calculated from the length of the plume and elapsed time since operations utilizing the compounds of interest began at each facility (length /time). The actual contaminant transport velocities in groundwater at OU2 may differ from these apparent rates.</p> |
| 2 | <p>The model was calibrated to heads, not flows as stated. The flows used by the USGS were assumed correct, and were not changed during calibration. Parameter estimation was used to calibrate heads within acceptable levels, but this solution is non-unique and depends heavily on the accuracy of the flows which make up the water balance. In the case of this model, heads are the most accurately known parameter, and flows are one of the most uncertain, yet without knowing flows, there is no way to know what K-field is correct, since an infinite number of Ks will calibrate to the same set of heads.</p> <p>Calibration to heads will not ensure that the modeled velocities are correct, since for a given gradient, velocity is a function of the ratio of flow to conductance. Some effort should be made to also verify boundary flows in order to reduce uncertainty.</p> | <p>Yes, the model was calibrated to heads. The majority (>90%) of the flows assigned to the model are based on actual field data (pumping rates and recharge to spreading basins).</p> <p>Because it is not possible to measure groundwater flows in the field, to determine the remaining flows (i.e., infiltration of rainfall, flow across a fault zone assigned as model boundary) we extracted the relevant quantities from the existing, peer-reviewed USGS model.</p> <p>In our RI model, almost 100% of the flow through the model domain was specified on input; thus the model calibration is flow-constrained.</p> <p>Our RI model refined the upper most layers (for a total of 13 layers) and then compared that model to actual field observations as part of the calibration. The "error" of the model, is well within the acceptable range.</p> <p>Please see below our earlier response to DTSC's Comment 14 on the draft RI that addresses the same issues:</p> <p><i>The Omega model was calibrated to observed water levels. The flow components were used as model input, not output; as such, the model was not calibrated to the flow components. There are uncertainties in the magnitude of all of these flow components, including groundwater production rates. The uncertainties were addressed through model sensitivity analyses. No flow data suitable for use as a calibration data set were available. However, the flow into and out of the model was prescribed on input so the calibration to heads was constrained by the specified flow through the model. The specified head boundaries were placed along flowlines to limit the flow across them (Please see our response to Comment 13). The clarification of April</i></p> |

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| | | <p>2, 2008 requested that DTSC identify the flows to be used in calibration.</p> <p>EPA received the DTSC RI comments dated March 24, 2008 on April 1, 2008 and responded in a letter dated May 8, 2008. DTSC concurred with EPA's response to the comments on the draft RI via e-mail dated June 18, 2008 and stated that "TOC and sorption issues will continue to be assessed."</p> |
| 3 | <p>The groundwater model calibration relies on an assumption that boundary flows are accurate. As a result, there is considerable uncertainty in the results, which could be reduced by further constraining flows at the boundaries.</p> <p>A groundwater budget for the model is needed that compares boundary inflows by category, including layer-by-layer pumpage, recharge, and outflow. If recharge and discharge from constant-head nodes significantly exceeds areal recharge and mountain-front recharge, then these terms have likely been overestimated, and therefore hydraulic conductivity in the lower model area is overestimated.</p> | <p>Please see below our response to DTSC's Comment 15 on the draft RI which addresses the same issues:</p> <p><i>The model boundary was selected in a way to minimize the groundwater exchange across the boundary, i.e., parallel to the groundwater flow direction. The budget analysis also indicated that there is little water exchange through the specified head boundaries, with the exception of the boundary segment near the spreading basins where a portion of the recharged water flows out of the model domain. This is expected to be the actual condition.</i></p> <p><i>The model volumetric budget showing breakdown by boundaries will be included in the report. It is included in Attachment 2.</i></p> |
| 4 | Quantitative velocities calculated by the model should not be relied on until additional work is done to verify flow rates and volumes. | Agreed. Velocities (direction and magnitude) calculated by the model were not used in support of the FS other than for particle tracking to simulate capture. |
| 5 | Tabulation of the model water budget by zone and boundary type would be very useful to document the model water budget. In general, subsurface inflow and outflow ought not exceed areal recharge, and certainly not by orders of magnitude. | Agreed. Similar to comment 2 above ... please see our response to DTSC's Comment 15 on the draft RI that addresses the same boundary issues. |
| 6 | Because the design of the pump-and-treat options rely heavily on the aquifer being able to sustain the calculated flow rates, any uncertainty in transmissivity due to errors in boundary flows will translate into uncertainty in the number, placement, pump rates, and costs of the treatment system wells. | The capture zone simulation in the FS was mainly used for cost estimates. The FS states that the actual number and placement of extraction wells, and the pumping rates should be determined during the Remedial Design (RD). It may not be necessary to sustain the calculated rates; rather, the |

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| | Uncertainty in plume velocity will translate into cleanup time estimates varying from the design. | <p>system will need to utilize sufficient number of extraction wells operating at such rates as will achieve capture. Besides modeling, additional lines of evidence (i.e., measured water levels, computed groundwater gradients, particle tracking on contoured water levels, long term GW sampling at sentinel wells, etc.) will be used to confirm capture.</p> <p>Cleanup time was not estimated in the FS (and will not be estimated in RD) because the goal of the interim remedy is to achieve plume capture, not aquifer restoration.</p> |
| 7 | <p>The FS includes the plume map of only PCE while the proposed alternatives include remediation of other COCs as well. Figures showing all the COC plumes requiring remediation should be provided to assess their locations and magnitude with respect to the overall 4.5 miles plume, and to evaluate if the proposed alternatives are appropriate and/or cost-effective.</p> <p>This information may have been in the RI, however, those figures are pertinent to the proposed remediation alternatives and should be presented in the FS for ease of review.</p> | <p>The FS shows the boundary of OU2 which is based on the exceedances of regulatory standards for all contaminants present in groundwater.</p> <p>For the modeling, the FS relied on the extent of the PCE plume mainly because the PCE plume is the most extensive, and is the main risk driver at the site.</p> <p>Additional plume figures from the RI could be added to the FS, but because the final RI/FS will be released as one document we do not believe this is necessary.</p> |
| 8 | <p>Groundwater modeling - The simulated PCE plumes for all the alternatives show that, after 30 years, the width of the plume would somewhat shrink while the length would remain the same, and PCE concentrations ranging from 5 to 50 ug/L at the edge of the current plume would persist.</p> <p>Unless there is change in current regulations, the remediation will likely be required to continue after the 30 year period. Therefore, it is important to simulate how long it takes to achieve MCL within the plume so that both the financial and environmental lifetime cost of the project can be estimated, or if there is other more effective remedial alternative should be considered.</p> | <p>The time to achieve aquifer restoration was not estimated in the FS because it is not the objective of the interim remedy. The goal of the interim remedy is to contain the plume.</p> <p>Agree. Based on the nature and extent of groundwater contamination at OU2, based on the status of remediation efforts at the state-lead sources of groundwater contamination at OU2, and also considering the industry experience at similar sites, more than 30 years will likely be required for aquifer restoration.</p> |

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| 9 | <p>Extraction well locations - although extraction well locations may have been selected based on plume capture requirement, EPA should consider various extraction strategies to maximize mass removal rate while minimizing volume. DTSC would like the following scenarios be considered</p> <p>a) extracting from the 500 ug/L plume to increase mass removal,</p> <p>b) extracting at the edge of the 100 ug/L plume instead of at 5 ug/L, and simulate the maximum impact on the active production wells, particularly, the ones with current wellhead treatments, evaluate if the diluted portion of the plume can be handled with the existing active wells.</p> | <p>The goal of the FS is to achieve containment of the plume. The extraction well locations were selected to achieve capture of the plume, i.e., capture groundwater with COC concentrations in excess of the MCLs and Notification Levels (e.g., 5 ug/L for PCE and TCE).</p> <p>This interim remedy will likely utilize more extraction wells than shown in the FS; their number and locations will be determined during the RD. The actual well locations will be determined by access and other considerations.</p> <p>DTSC's suggestions (a thru d) will be considered at the time of remediation and clean up after the interim remedy is in place. The issues of source containment at state-lead facilities within OU2 will be considered at that time.</p> <p>Maximizing the mass removal rate is not the objective of the interim remedy. The goal is containment and to keep high concentrations from moving into areas of lower concentration.</p> <p>a) Note: the Central and the Northern Extraction areas in the plume-wide extraction scenarios do, in fact, align with the 500 ug/L plume lines</p> <p>b) Note: the extraction well locations were selected to achieve capture at the leading edge of the plume, i.e., the 5 ug/L PCE contour. From a practical perspective, given the proximity of the 100 ug/L contour to the leading edge, there is no significant difference between extraction at the leading edge and extraction at the edge of the 100 ug/L contour (for the same pumping rates).</p> <p>Partial containment, such as containing only groundwater with "high" COC concentrations (e.g., higher than 100 ug/L), is not likely to decrease the COC</p> |

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| | <p>c) treating the 1,4-dioxane and/or Cr VI plumes separately as hot spot removal, if feasible, to reduce both capital and O&M cost. Perform cost-effective analysis of localized/hot spot removal versus centralized treatment as is in the proposed FS.</p> <p>d) simulate the above scenarios over several periods of time the same way as in Appendix A including time for reaching MCL.</p> | <p>concentrations before the contaminated groundwater reaches other (yet un-impacted) production wells downgradient of OU2, and would not satisfy RAO 1. The FS is being revised to incorporate a more detailed discussion of this issue.</p> <p>More than 10 production wells are located within about one mile from the leading edge of the OU2 plume. The timing and magnitude of impact on those production wells would depend on their future extraction rates and would not be controlled by the remedy. Partial containment would also allow COCs to migrate into uncontaminated portions of the aquifer (both laterally and vertically), and would not satisfy RAO 2. Consequently, partial containment was screened out because there would be a high degree of uncertainty of COC concentrations reaching new downgradient receptors and COCs would spread into uncontaminated aquifer zones.</p> <p>c) Note: See b above. The FS identifies treatment requirements that are needed now for the existing plume, and those requirements (and the technologies used to meet them) will be refined during RD. The feasibility and cost-effectiveness of future hot spot removals will be assessed as work continues at the state-lead sites and decisions are made about source area clean ups and future OU2 remedial actions.</p> <p>d) See b and c. The assessment of hot spot treatment and time for reaching MCL clean up will be assessed in the next phase of remedial activities.</p> |

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| 10 | Influent concentration - Simplified assumptions were made to estimate the design basis influent concentration and indicated that a more rigorous method will be used during the RD phase. Given the relatively low influent concentrations of 1,4-dioxane and Cr VI compared to their discharge limitations, DTSC believes it is prudent to use fate and transport modeling to estimate their concentrations at extraction points and to determine whether or not the additional treatments are necessary, especially with the recommendation in General Comment 3(c). | To include the drinking water end use, the interim remedy will have to assure that the treated water meets all applicable standards and is adequately protective of public health. Numerical modeling may be utilized to assist the RD, and future groundwater monitoring data will provide additional empirical evidence for the treatment requirements. It's also important to note that the actual influent concentrations over the life of the remedy will depend to a large degree on the source control measures adopted at the state-lead and other facilities that contribute Cr ⁶⁺ , 1,4-dioxane, and other compounds to groundwater contamination by at OU2. |

Specific Comments

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| 1 | Alternative 2 - LE: Advanced Oxidation Process (AOP) for treating 1,4-dioxane will incur a considerable cost. Table 3-2 shows the design influent concentration of 3.6 ug/L for the first 15 years, and 7.1 ug/L for the second 15 years. The drinking water discharge limits for 1,4-dioxane is 3 ug/L. As the estimated influent concentration is very close to the discharge limit, the need for the AOP for this alternative should be reevaluated. See General Comment 4 above. | Please see our response to General Comment 10. Assuming that the selected remedy has a drinking water end use, the type of treatment required will also have to comply with whatever requirements CDPH establishes under the 97-005 process. |
| 2 | Table 3-2 thru Table 3-5: Influent concentrations of Cr VI for Alternative 2 thru 5 are higher than the discharge limits, but only Alternatives 3 and 5 consist of ion exchange units for removal of Cr VI. This discrepancy need to be rectified for Alt. 2 and 4, and the cost of these alternatives should also be adjusted. | <p>Alternative 2 uses nanofiltration (NF) for both total chromium and TDS removal (NF will remove Cr⁶⁺ incidentally as well). Alternative 4 uses reverse osmosis (RO) for Cr⁶⁺ and TDS removal (Cr⁶⁺ has a low discharge limit for injection end use).</p> <p>In general, the overall approach was to represent a range of treatment options in the FS; the actual combination of treatment technologies may be modified during the RD. For example, either ion exchange or membrane technologies (RO or NF) are</p> |

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| | | suitable for Cr ⁶⁺ removal. Furthermore, ion exchange was used in some of the alternatives to remove Cr ⁶⁺ upstream in the process, such that a smaller RO process could be used just to meet TDS limits. There are other combinations of technologies that should be evaluated in the RD. |
| 3 | Table 3-6: The extraction scenario for Alternative 6 is the same as Alternatives 3 thru 5. But, Cr VI is missing from Table 3-6 and no ion exchange unit is included in the treatment process. See comment 2 above. | Alternative 6 does not require treatment for total chromium because the extracted GW concentration is less than the total chromium MCL of 50 ppb. In contrast, Alternatives 3 through 5 have lower specific Cr ⁶⁺ discharge limits associated with their end use. However, it should be noted that the NF unit that is included in Alternative 6 primarily for TDS removal will also remove total chrome and Cr ⁶⁺ incidentally. |
| 4 | Process flow diagrams: The AOP could cost more than LGAC to treat VOCs. And, since the AOP is intended for removal of 1,4-dioxane, DTSC recommends to evaluate the cost difference by moving LGAC upstream of AOP to remove the VOCs first. | The LGAC was placed after AOP in the FS because AOP generates partial oxidation byproducts and generally needs LGAC polishing; the treatment train used in the FS is simple. The arrangement DTSC suggested should be evaluated in the RD to see if it is overall more cost effective. Please also see our response to General Comment 10. |
| 5 | Page 2-1, Section 2.2 (Remedial Action Objectives) Table 2-1, Identifies the COC hexavalent chromium screening level as 11 µg/L. This is based on the protection of aquatic life and would only be relevant for discharge into a surface body of water. Currently, DTSC is using the California MCL for total chromium (50 µg/L) for combined hexavalent and trivalent chromium, as a cleanup goal for beneficial use groundwater. | <p>We concur with the comment. Table 2-1 will be revised by adding: "Applicable to surface water discharges only, see discussion in text regarding drinking water."</p> <p>However, besides these requirements and the potential Public Health Goal (PHG), the remedy will have to satisfy the requirements set by the end user, i.e., the purveyor or municipality, to use the specific discharge option as discussed on page 2-14. Please note that water purveyors currently do not accept water with 50 µg/L of Cr⁶⁺ as drinking water. The alternatives developed in the FS can meet any of the concentration requirements considered in the document. The specific Cr⁶⁺ treatment requirements will be determined during the RD.</p> |

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| 6 | <p>Page 2-14, Section 2.3.3.4 (To-Be-Considered Criteria, Total and Hexavalent Chromium): Regarding the screening level for hexavalent chromium, please see Comment No.1. Recently, the Office of Environmental Health Hazard Assessment (OEHHA) developed a draft PHG of 0.05 µg/L for hexavalent chromium. However, this PHG is still draft and has not been finalized. As stated previously, DTSC is currently using the total chromium MCL of 50 µg/L as the cleanup goal for groundwater.</p> | <p>Please see our response to Specific Comment 5.</p> |
| 7 | <p>Page 3-1, Section 3 (Development of Alternatives): Table 3-2 lists a drinking water discharge limit of 5 µg/L for hexavalent chromium; should this be 50 instead of 5? For Table 3-4, the drinking water discharge limit for hexavalent chromium for reinjection water is listed as 8 µg/L, which is the limit for the Los Angeles River and is designed for protection of ecological receptors in a sensitive surface water body, not drinking water.</p> | <p>The value will be revised to 50 µg/L and a footnote "Actual discharge limit will be determined during RD, see discussion in text." will be added. Please also see our response to Specific Comment 5.</p> |